KEY ISSUES OF ELECTRICAL APPLICATIONS OF DIAMOND

Naoji Fujimori

National Institute of Advanced Industrial Science and Technology, Diamond Research Center
AIST TC Central 2, 1-1-1 Umezono, Tsukuba 305-8568, JAPAN

Diamond has many superior characteristics, which is promising to be applied in electrical applications. However, realized products are quite few and the volume of products is still very small. It is common sense that the difficulty of realization is caused by diamond's price. hard machinability and infantile controllability of diamond itself.

Many recent research results brought us to recognize the progress of controlling diamond quality both bulk and thin film. Additionally, the controlling of diamond surface, which gives some superior characteristics of diamond, made promising the wide application of diamond such as electron emission, bio application etc. As the result of such progress, target of development for diamond products looks hopeful because the advantage of diamond may be easily confirmed.

On the other hand, issues related on production have not yet been dissolved and choosing of development target is still very difficult caused by the hard estimation of production cost. One of the most important materials for electrical application is "wafer". As the fabrication line of diamond products may not be exception, using of wafer is the necessity, hopefully larger than 3-inch wafer. Current largest single-crystalline diamond, in commercial, is 10x 10mm and the price of it is more than 10 times than other semiconducting materials. However, we can obtain poly-crystalline wafer with the size of 2 or 3 inch and their price look reasonable. Moreover, nano-crystalline diamond gives us to obtain less expensive wafer if you do not need finished surface.

Micro machining technology of diamond has progressed in these several years by using of dry etching process and the nano-scale diamond can be obtained. However, macro-scale machining, such as polishing and cutting, is still very hard and costly. Thus, the fabrication process of diamond devices looks to be incomplete.

The author will summarize current status of electrical application of diamond and will present the target of development for real production process.